Surface areas And Volumes

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Cube

6-Face

$l = b = h = a$

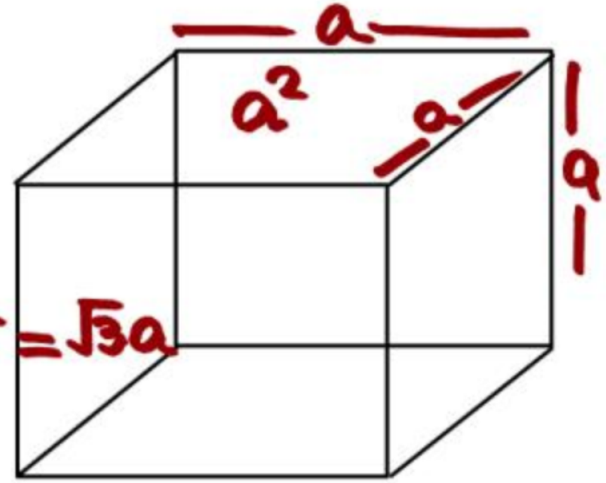
If the length of each edge of a cube is 'a' units then

i) Total surface area of the cube = $6a^2$

ii) Volume of the cube= $a \times a \times a = a^3$

iii) Diagonal of the cube= $\sqrt{a^2 + a^2 + a^2} = \sqrt{3a^2} = \sqrt{3}a$

iv) lateral surface area= $4a^2$



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Cuboid

No Face - 6

3D

If the length=l , breadth=b height=h

i) Total surface area of the Cuboid $= 2(lb+bh+lh)$

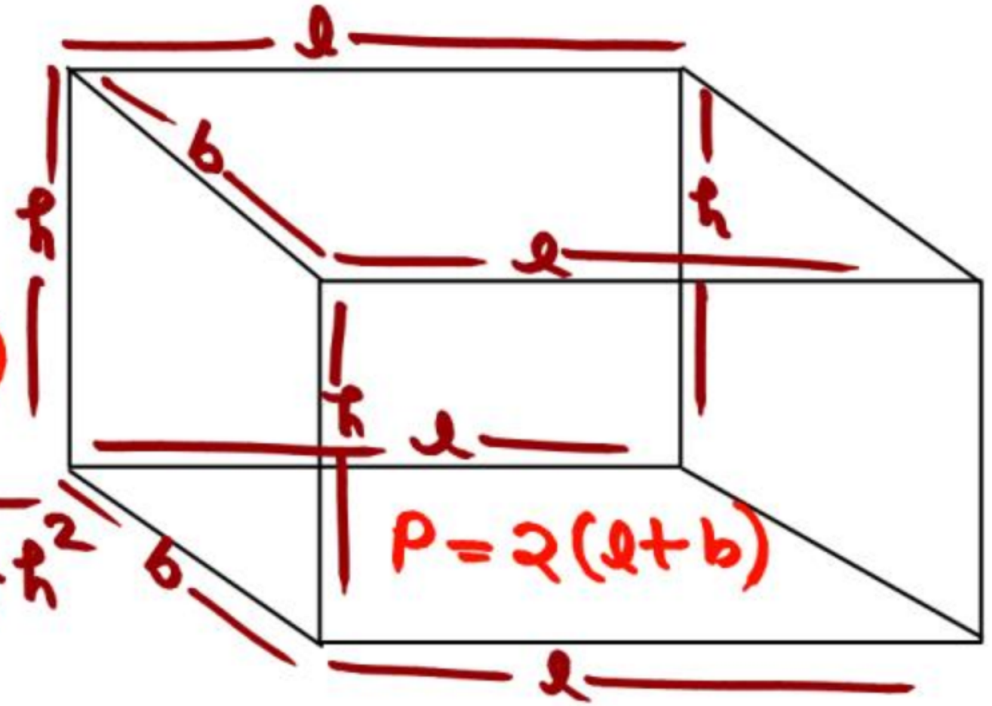
ii) Volume of the Cuboid $= l \times b \times h$

iii) Diagonal of the Cuboid $= \sqrt{l^2+b^2+h^2}$

iv) lateral surface area $= 2(bh+lh)$

$= 2h(b+l)$

$= h[2(l+b)] =$ height × Base of Perimeter



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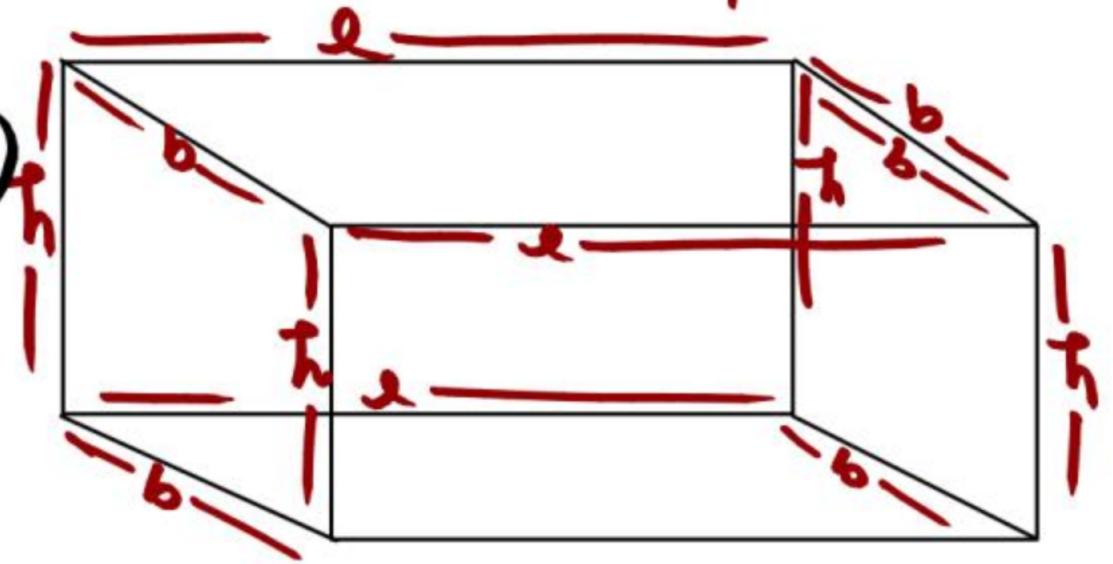
Total S.A of Cuboid = $l \times b + l \times b + b \times h + b \times h + h \times l + h \times l$

T.S.A of Cuboid = $2(lb + bh + lh)$



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Right Circular Cylinder

No of Face = 3

i) Area of base= πr^2

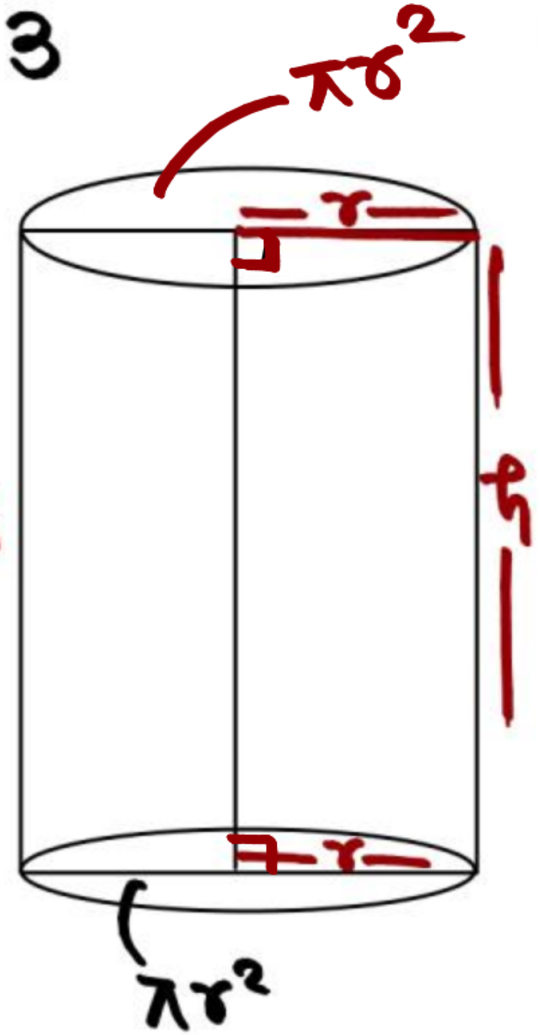
ii) Curved surface area= $2\pi rh$

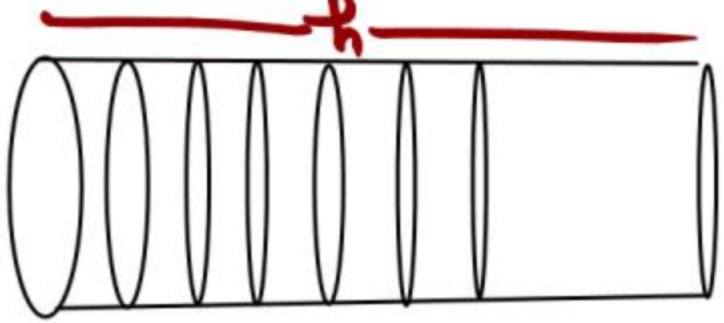
iii) Total surface area= $\pi r^2 + \pi r^2 + 2\pi rh$

$= 2\pi r^2 + 2\pi rh$

$= 2\pi r(h + r)$

iv) Volume= $\pi r^2 h$





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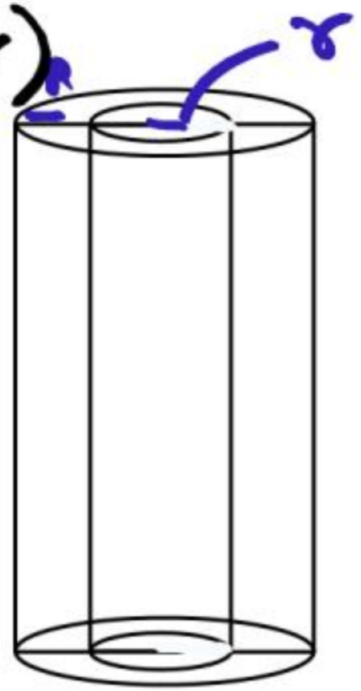
Right Circular hollow Cylinder

i) Area of each end= $\pi R^2 - \pi r^2 = \pi(R^2 - r^2)$

ii) Curved surface area of hollow cylinder= External surface area + Internal surface $= 2\pi Rh + 2\pi rh = 2\pi h(R+r)$

iii) Total surface area = $\pi(R^2 - r^2) + 2\pi h(R+r)$

iv) volume of material = $\pi(R^2 - r^2) \times h$



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Right Circular Cone

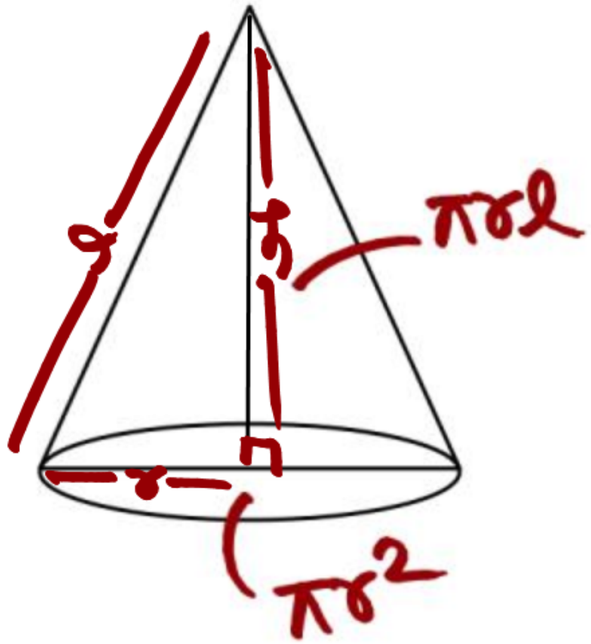
No Face = 2

i) Slant height (l)= $\sqrt{r^2+h^2}$

ii) Area of curved surface = $\pi r l$

iii) Total surface area= $\pi r(l+r)$

iv) Volume= $\frac{1}{3}\pi r^2 h$



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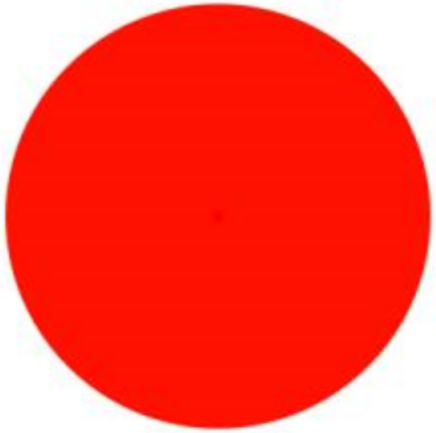
Sphere

Surface area= $4\pi r^2$

Volume= $\frac{4}{3}\pi r^3$



Hemisphere

Area of curved surface = $2\pi r^2$

Total Surface area= $2\pi r^2 + \pi r^2 = 3\pi r^2$

Volume= $\frac{2}{3}\pi r^3$

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Two cones have their heights in the ratio 1:3 and radii in the ratio 3:1. What is the ratio of their volumes?

CBSE Delhi Set-1 2020

$h_1 : h_2 = \frac{h_1}{h_2} = \frac{1}{3}$ $\quad r_1 : r_2 = \frac{r_1}{r_2} = \frac{3}{1}$ $\quad \frac{V_1}{V_2} = ?$

$h_1 = x$ $\quad r_1 = 3y$ $\quad r_2 = y$

$h_2 = 3x$

$V_1 = \frac{1}{3}\pi r_1^2 h_1$

$V_2 = \frac{1}{3}\pi r_1^2 h_2$

$$\frac{V_1}{V_2} = \frac{\frac{1}{3}\pi r_1^2 h_1}{\frac{1}{3}\pi r_2^2 h_2} = \left[\frac{r_1}{r_2}\right]^2 \frac{h_1}{h_2}$$

$$= \left[\frac{3y}{y}\right]^2 \times \frac{x}{3x} = \frac{9y^2}{y^2} \times \frac{1}{3} = \frac{3}{1}$$

$V_1 : V_2 = 3:1$

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Two cubes have their volumes in the ratio 1:27 Find the ratio of their surface areas

CBSE Delhi Set-1,II,III 2018

$$V_1 : V_2 = 1:27$$

$$\frac{V_1}{V_2} = \frac{1}{27} \Rightarrow \frac{a_1^3}{a_2^3} = \frac{1}{27} \Rightarrow \left[\frac{a_1}{a_2}\right]^3 = \frac{1}{27} \Rightarrow \boxed{\frac{a_1}{a_2} = \frac{1}{3}}$$

$$\frac{S_1}{S_2} = \frac{\cancel{6}a_1^2}{\cancel{6}a_2^2}$$

$$\frac{S_1}{S_2} = \left[\frac{a_1}{a_2}\right]^2 = \left[\frac{1}{3}\right]^2 = \frac{1}{9}$$

$$\boxed{S_1 : S_2 = 1:9}$$

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Solid is in the shape of a cone mounted on a hemisphere of same base radius. If the curved surface area of the hemispherical part and the conical part are equal, then find the ratio of the radius eg and the height of the conical part.

CBSE Delhi Set-II,III 2020

C.S.A of Hemisphere = C.S.A of cone.

$$2\pi r^2 = \pi r l$$

$$2\cancel{\pi} r^2 = \cancel{\pi} r \sqrt{h^2+r^2}$$

$$2r = \sqrt{h^2+r^2}$$

Sq Both.

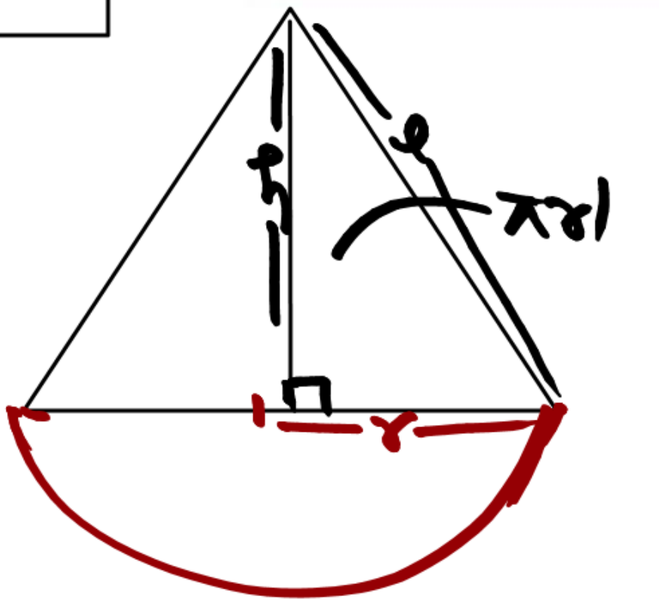
$$4r^2 = h^2+r^2$$

$$4r^2 - r^2 = h^2$$

$$3r^2 = h^2$$

$$\frac{r^2}{h^2} = \frac{1}{3}$$

$$\frac{r}{h} = \frac{1}{\sqrt{3}}$$



$$l = \sqrt{h^2+r^2}$$

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From a solid right circular cylinder of height 14 cm and base radius 6 cm, a right circular cone of same height and same base removed. Find the volume of the remaining solid.

CBSE Delhi Set-II,III 2020

Volume of Cylinder $= \pi r^2 h$

Volume of Cone $= \frac{1}{3}\pi r^2 h$

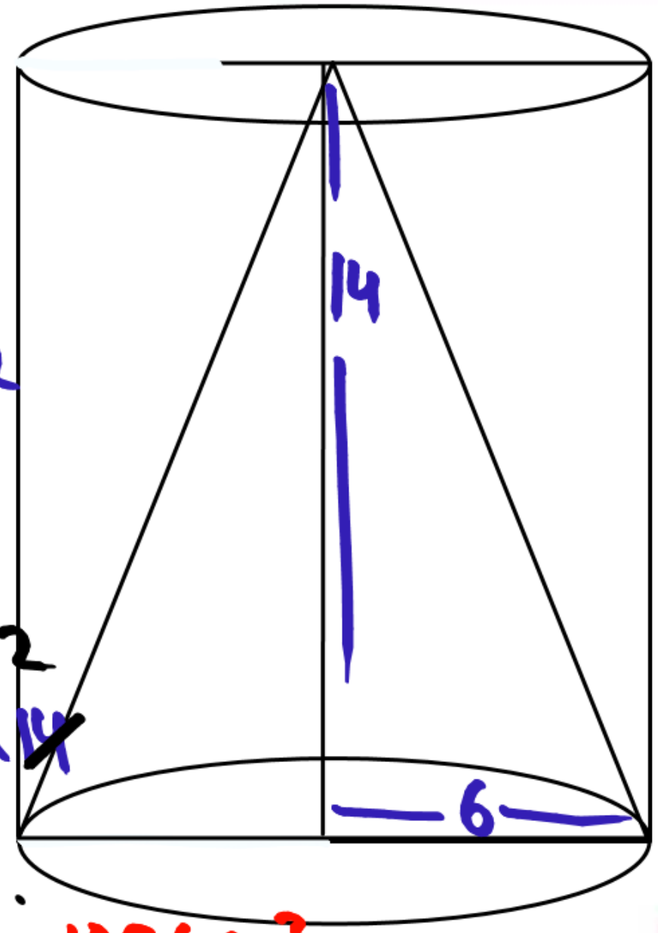
Volume of remaining part = V. of cylin − V. cone

$= \pi r^2 h - \frac{1}{3}\pi r^2 h$

$= \frac{2}{3}\pi r^2 h = \frac{2}{\cancel{3}} \times \frac{22}{\cancel{7}} \times \cancel{6} \times 6 \times \cancel{14}$

$= 44 \times 4 \times 6$

$= 1056\ cm^3$



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The curved surface area of a right circular cylinder is 176 sq cm and its volume i
1232 cu cm. What is the height of the cylinder?

CBSE Delhi Set-II,III 2022

C.S.A of Cylinder = 176 Sq. Cm.

V. of Cylinder = 1232

V. of Cylinder = $\pi r^2 h$

C.S.A of Cylinder = $2\pi r h$

$176 = 2\pi r h$

$4 \times 88 = \frac{22}{7} \times r h$

$28 = r h$

$28 = 14 h$

$\frac{28}{14} = h$

$2 = h$

$1232 = \pi r^2 h$

$1232 = \pi r (rh)$

$1232 = \frac{22}{7} \times r (28)$

$\frac{1232}{22 \times 4} = r$

$\frac{154}{11} = r$ $\Rightarrow r = 14$ cm

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The largest sphere is carved out of a solid cube of side 21 cm. Find the volume of the sphere.

CBSE set-1 2022

Radius $= \frac{21}{2}$ cm.

V. of Sphere $= \frac{4}{3}\pi r^3$

$$= \frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}$$

V. of Sphere $= 11 \times 21 \times 21$ cm^3

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A solid is in the form of a cylinder with hemispherical end. The total height of the solid is 20 cm and the diameter of the cylinder is 7 cm find the total volume of the solid.

CBSE set-1 2019

Total Volume of Solid = 2-hemisphere volume + V. of cylinder.

$= 2 \times \frac{2}{3}\pi r^3 + \pi r^2 h$

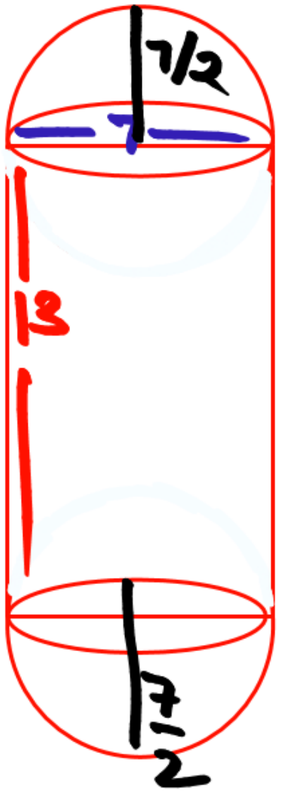
$= \frac{4}{3}\pi r^3 + \pi r^2 h$

$= \frac{4}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2} + \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 13$

$h = 20 - \left(\frac{7}{2} + \frac{7}{2}\right)$

$h = 20 - 7 = 13$

20 Cm



Radius $= \frac{7}{2}$

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A tent is of the shape of a right circular cylinder up to a height of 3 meters and then becomes a right circular cone with a maximum height of 13.5 meters above the ground. calculate the cost of painting the inner side of the tent at the rate of 2 Rs per square metre , if the radius of the base is 14 meters.

CBSE 2005

C.S.A of Cone = $\pi r l$

C.S.A of Cylinder = $2\pi r h$

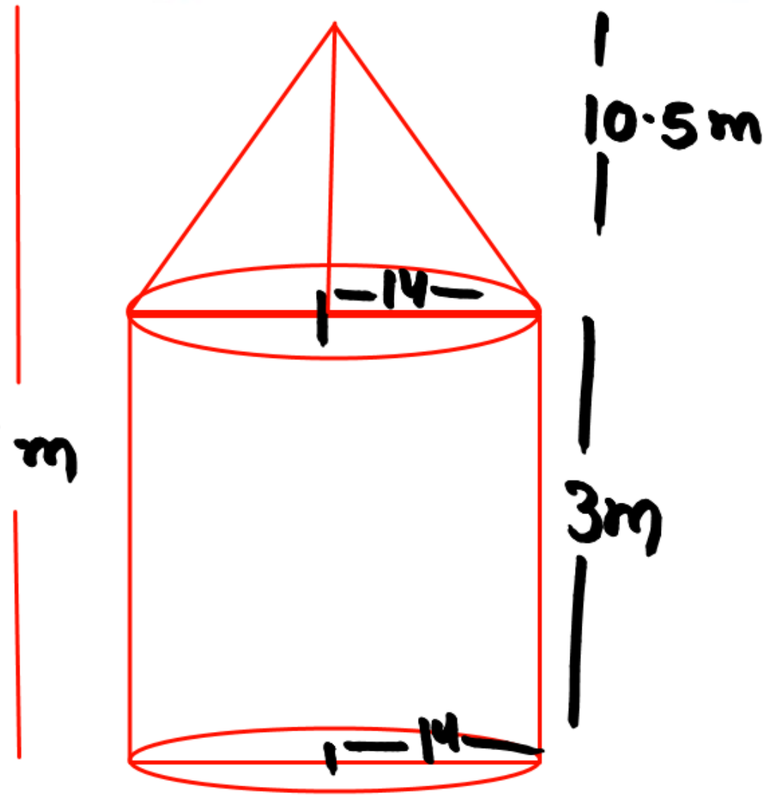
$l = \sqrt{(10.5)^2 + (14)^2}$

Total C.S.A = C.S.A of Cone + C.S.A Cylin

Rate = (C.S.A of Cone + C.S.A Cylinde) × 2

=

Any



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A wooden article was made by scooping out a hemisphere from each end of a sold cylinder as shown in fig .if the height of the cylinder is 10 cm and its base is of radius 3.5 cm find the total surface area of the article.

CBSE 2014 2018

T.S.A of Article = C.S.A of Cylinder + S.A of Hemi.

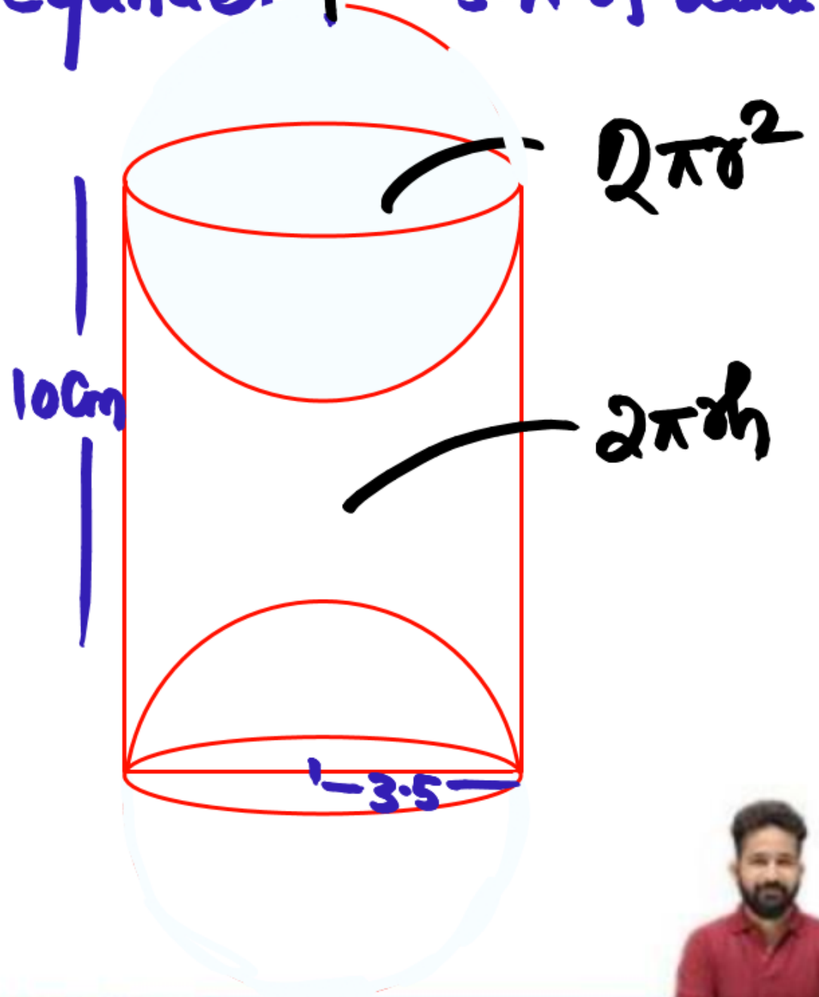
$= 2\pi rh + 2(2\pi r^2)$

$= 2\pi r(h + 2r)$

$= 2 \times \frac{22}{7} \times 3.5 [10 + 3.5 \times 2]$

$2 \times \frac{22}{\cancel{7}_{1}} \times \cancel{3.5}^{5} [10 + 7]$

$10 =$ Ans



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